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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force **Date:** April 2022

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>
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COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	-	33.162	53.750	36.997	0.000	36.997	42.398	45.552	50.754	51.882	Continuing	Continuing
63665A: <i>Advanced Aerospace Sensors Technology</i>	-	33.162	19.664	16.204	0.000	16.204	18.651	21.248	23.790	24.319	Continuing	Continuing
6369DF: <i>Target Attack and Recognition Technology</i>	-	0.000	34.086	20.793	0.000	20.793	23.747	24.304	26.964	27.563	Continuing	Continuing

A. Mission Description and Budget Item Justification

The program develops and demonstrates advanced technologies for electro-optical sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. It also develops and demonstrates radio frequency (RF) and electro-optical (EO) sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. This program develops the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. This program has been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

The Department of the Air Force technologies in this program are both enabling and enduring as we invest in maturing emerging technologies that address established mission gaps, and transformational technologies that address integrated enterprise capabilities intended to reshape the future force across air, space, and cyber warfighting domains. Development of transformational operational capabilities through advanced technology solutions focuses on five strategic capabilities: Global Persistent Awareness; Resilient Information Sharing; Rapid, Effective Decision-Making; Complexity, Unpredictability, and Mass; and Speed and Reach of Disruption and Lethality.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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B. Program Change Summary (\$ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	35.274	44.730	0.000	0.000	0.000
Current President's Budget	33.162	53.750	36.997	0.000	36.997
Total Adjustments	-2.112	9.020	36.997	0.000	36.997
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-1.014			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	9.300			
• Congressional Directed Transfers	0.000	0.734			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-0.698	0.000			
• Other Adjustments	-1.414	0.000	36.997	0.000	36.997

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 6369DF: *Target Attack and Recognition Technology*

Congressional Add: *Program increase: software verification and validation for autonomous sensors*

Congressional Add Subtotals for Project: 6369DF

Congressional Add Totals for all Projects

	FY 2021	FY 2022
	0.000	9.300
	0.000	9.300
	0.000	9.300

Change Summary Explanation

Decrease in FY 2021 reflects adjustments to support Research and Development Projects, 10 U.S.C. Section 2363, an amendment to PL 110-417, 10 U.S.C. Section 2358 and 10 U.S.C. 2805(d)(1)(B).

The FY 2022 President's Budget submittal did not reflect FY 2023 through FY 2026 funding. Therefore, an explanation of the change between the two budget positions for FY2023 cannot be made in a relevant manner.

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Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>				Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
63665A: <i>Advanced Aerospace Sensors Technology</i>	-	33.162	19.664	16.204	0.000	16.204	18.651	21.248	23.790	24.319	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project area develops and demonstrates aerospace sensor and processing technologies for intelligence, surveillance, reconnaissance, target, and attack radar applications in both manned and unmanned platforms, including electro-optical sensors and electronic counter-countermeasures for radars. It provides aerospace platforms with the capability to precisely detect, track, and target both airborne (conventional and low radar cross-section) and ground-based, high-value, time-critical targets in adverse clutter and jamming environments. Project activities include developing multi-function radio-frequency systems including radar and electronic warfare technology and the position and timing information to enable distributed sensing. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Persistent Sensing in Contested Environment Technologies	2.903	0.000	0.000
Description: Develop active radio frequency sensor solutions to use against difficult-to-detect targets in challenging environments, and advanced radio frequency architectures for open and reconfigurable systems. Enable persistent intelligence, surveillance and reconnaissance over wide areas, and detect advanced air and ground targets.			
FY 2022 Plans: Not applicable			
FY 2023 Plans: Not applicable			
Title: Passive/Multi-Mode Sensing	5.777	6.817	7.816
Description: Develop advanced techniques and prototype passive radio frequency sensors to intercept, collect, locate and track enemy radio frequency sensor systems for intelligence, surveillance and reconnaissance of air and ground targets.			
FY 2022 Plans:			

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>Continue development and ground demonstrations of illumination selection manager to address more complex signal environments and implementation in open architectures. Complete platform level modeling to evaluate key parameters for passive multi-mode radar performance. Continue mission level modeling to evaluate passive multi-mode system effectiveness for relevant scenarios. Continue implementation of electronic support, passive radar and illumination selection manager subsystems in advanced digital antenna architectures. Initiate implementation of illumination selection manager into sensor resource manager. Complete systems engineering study to identify subsystem enhancements for airborne passive multi-mode. Begin integration of illumination selection manager and/or passive multi-mode radar on existing airborne platforms. Initiate planning for airborne passive multi-mode demonstration.</p> <p>FY 2023 Plans: Complete development of core illumination selection manager algorithms that operate in complex signal environments. Continue mission level modeling to evaluate system effectiveness for relevant operational scenarios. Complete implementation of electronic support, passive radar and ISM subsystems in advanced wideband digital active electronically scanned arrays. Perform a ground-based integrated demonstration incorporating a state-of-the-art digital active electronically scanned arrays. Complete implementation of illumination selection manager into sensor resource manager, demonstrating that illumination selection manager subsystem interfaces are compliant with open architectures. Continue integration of illumination selection manager and/or passive multi-mode radar on existing airborne platforms. Continue planning for follow-on airborne demonstration.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: FY 2023 increased compared to FY 2022 by \$0.999 million. Justification for this increase is described in plans above.</p>				
<p>Title: Long Range Sensing Technologies</p> <p>Description: Develop radio frequency sensor technology to detect, locate, and identify air and ground targets at long ranges, including those that are low-observable, or use deception or camouflage.</p> <p>FY 2022 Plans: Not applicable</p> <p>FY 2023 Plans: Not applicable</p>		2.785	0.000	0.000
<p>Title: Triple Raven Advanced Technology Demonstration</p> <p>Description: Advance, demonstrate, and transition innovative imaging and non-imaging optical sensing technologies for surveillance and reconnaissance of airborne and ground-based objects of interest in an anti-access/area denial environment. This effort includes the development of systems, subsystems, and components necessary to yield new capabilities.</p>		7.942	7.776	6.081

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
<p><i>FY 2022 Plans:</i> Continue design and development of complete surveillance demonstration system. Complete development of laser radar transmitter, receiver, and integrate with passive imaging systems and control system. Conduct lab testing of entire system. Prepare for long-range ground demonstration of system at government test range.</p> <p><i>FY 2023 Plans:</i> Complete development of turbulence mitigation algorithms. Finalize assembly of the entire passive and active electro-optical sensor system. Conduct long range mountain-to-ground demonstration of the system at a Government test range. Demonstrate performance of system during airborne data collections and ability of the system to meet program office data collection needs.</p> <p><i>FY 2022 to FY 2023 Increase/Decrease Statement:</i> FY 2023 decreased compared to FY 2022 by \$1.695 million. Funding decrease is a result of the Triple Raven Advanced Technology Demonstration effort ending in FY 2023.</p>			
<p><i>Title:</i> Transformational Technology Development</p> <p><i>Description:</i> Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through electro-optical and radio frequency sensing capabilities and algorithms. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p><i>FY 2022 Plans:</i> Select Transformational Technology Development efforts in FY 2022 that support the National Defense Strategy and Department of Air Force priorities.</p> <p><i>FY 2023 Plans:</i> Continue to develop and enable multi-domain sense-making at the tactical edge. Continue to develop radio frequency (RF) and electro-optical (EO) sensing capability to detecting, locating, and targeting airborne, fixed, and time critical mobile ground targets. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized</p>	0.000	5.071	2.307

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: FY 2023 decreased compared to FY 2022 by \$2.764 million. Funding decreased to scale investment toward the Department of the Air Force target outlined in the Air Force 2030 Science and Technology (S&T) Strategy.</p> <p>Title: Multidomain Analytic Development - Evolution</p> <p>Description: Develop enabling capabilities and technical know-how required for Department of the Air Force multi-domain command and control within highly contested environments through closed-loop central and decentralized sensing for battle management, automated onboard systems that use complex reasoning for situational awareness (SA) leading "intelligent" response, executive reasoning for selectable re-planners that provide task allocation. Use of shared models with both onboard reasoners and mission simulation and evaluation. Built with government-owned scalable closed-loop algorithms.</p> <p>FY 2022 Plans: Starting in FY 2022, this work is performed under Project 6369DF, Target Attack and Recognition Technology, Multidomain Analytic Development - Evolution effort.</p> <p>FY 2023 Plans: Not applicable</p>		13.755	0.000	0.000
Accomplishments/Planned Programs Subtotals		33.162	19.664	16.204
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
Not applicable				

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Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>				Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
6369DF: <i>Target Attack and Recognition Technology</i>	-	0.000	34.086	20.793	0.000	20.793	23.747	24.304	26.964	27.563	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project area develops and demonstrates advanced technologies for closed-loop, multi-domain, multi-intelligence sources, multi-platform, multi-sensor automation and autonomy, providing capabilities in battle management, fire control, battlespace awareness and visualization, predictive analytics, target recognition, sensor and information fusion, and sensor / platform asset tasking. This project also conducts advanced investigations to determine solution credibility, in terms of underlying technology and in terms of consistency with future Air Force missions within highly contested environments. This project includes robust techniques to support intelligence, surveillance, and reconnaissance and targeting missions within adverse weather conditions and against adversaries employing deceptive techniques. This project includes development of software-intensive solutions suitable for cloud-based integration and for development/operations-like operational environments. This project develops technology for effective management of online and offline information sources incorporating both constrained and cooperative sensing. This project has been realigned to better reflect technical areas being emphasized such as autonomy, multi-domain and multi-sensor information processing, leverage of machine learning developments and enterprise-level modeling, simulation and analysis.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2021	FY 2022	FY 2023
Title: Multidomain Analytic Development - Evolution	0.000	17.133	14.920
<p>Description: Develop enabling capabilities and technical know-how required for Department of the Air Force multi-domain command and control within highly contested environments through closed-loop central and decentralized sensing for battle management, automated onboard systems that use complex reasoning for situational awareness (SA) leading "intelligent" response, executive reasoning for selectable re-planners that provide task allocation. Use of shared models with both onboard reasoners and mission simulation and evaluation. Built with government-owned scalable closed-loop algorithms.</p> <p>FY 2022 Plans: Continue development of a prototype capability supporting the generation, evaluation, modification, and fielding of activity models for real-time use in automatically characterizing adversary behavior. Continue to demonstrate that activity modeling is a portable process, applicable to indications and warnings against a broad range of adversary activity. Continue integration of new component capabilities aimed at augmenting existing Department of the Air Force capability by developing processes used to</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
<p>generate adversary activity models and using those models to automatically generate indications and warnings alerts. Continue to integrate all components in an open-architecture testbed running on a cloud based environment.</p> <p>FY 2023 Plans: Continue the integration and demonstration of onboard and off-board intelligence, surveillance and reconnaissance algorithms to build a dominating intelligence, surveillance and reconnaissance capability against our adversaries. Continue the model, simulate and test new algorithm advancements for detection, identification, tracking, fusion, battle space awareness, predictive and prescriptive analytics, reasoning over an adversaries actions, collection, and execution of sensing and platform resources. Continue integration of new component capabilities aimed at augmenting existing Department of the Air Force capability by developing processes used to generate adversary activity models and using those models to automatically generate indications and warnings alerts. Continue to integrate all components in an open-architecture testbed running on a cloud-based environment.</p> <p>FY 2022 to FY 2023 Increase/Decrease Statement: FY 2023 decreased compared to FY 2022 by 2.213 million. Decrease is a result of reduced emphasis on simulating and testing advanced techniques.</p>				
<p>Title: Resilient & Agile Mission Systems Architecture</p> <p>Description: This project performs advanced development and demonstration of methods, technologies, and tools to enable resilience and protect mission systems against threats. This involves open and adaptable architectures for rapid integration and agile systems, cyber protections and resilience technologies to protect against threats. It integrates research efforts in electronic and cyber warfare to demonstrate novel operational capabilities through laboratory, field, and flight tests and experimentation. The goal is to reduce risk for rapid transition of novel operational capabilities into Air Force mission systems.</p> <p>FY 2022 Plans: Evolve and mature open architecture standards. Initiate development of advanced networking, processing, advanced computing paradigms, and cybersecurity technologies for next-generation avionics mission system capabilities. Apply agile software technologies and digital engineering techniques for rapid and affordable development, integration, and prototype capability demonstrations.</p> <p>FY 2023 Plans: Continue investigations to evolve and mature open architecture standards. Continue development of advanced networking, processing, advanced computing paradigms, and cybersecurity technologies for next-generation avionics mission system capabilities. Apply agile software technologies and digital engineering techniques for rapid and affordable development,</p>		0.000	4.185	3.500

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2021	FY 2022	FY 2023
integration, and prototype capability demonstrations. Initiate development of Reference Architecture Implementation for resilient mission systems. FY 2022 to FY 2023 Increase/Decrease Statement: FY 2023 decreased compared to FY 2022 by \$0.685 million. Justification for this decrease is described in plans above.				
Title: Transformational Technology Development Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through multi-sensor automation and autonomy, battlespace awareness and visualization, predictive analytics, target recognition, sensor and information fusion, and sensor/platform asset tasking. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made. FY 2022 Plans: Select new Transformational Technology Development efforts in FY 2022 that support the National Defense Strategy and Department of Air Force priorities. FY 2023 Plans: Continue to develop and enable multi-domain sense-making at the tactical edge. Continue to develop capabilities to provide real-time battle management, fire control, battlespace awareness and visualization, predictive analytics, target recognition, sensor and information fusion, and sensor/platform asset tasking. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process. FY 2022 to FY 2023 Increase/Decrease Statement: FY 2023 decreased compared to FY 2022 by \$1.095 million. Funding decreased to scale investment toward the Department of the Air Force target outlined in the Air Force 2030 Science and Technology (S&T) Strategy.		0.000	3.468	2.373
Accomplishments/Planned Programs Subtotals		0.000	24.786	20.793

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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>
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	FY 2021	FY 2022
Congressional Add: Program increase: software verification and validation for autonomous sensors	0.000	9.300
FY 2021 Accomplishments: Not applicable		
FY 2022 Plans: Conduct Congressional directed efforts		
Congressional Adds Subtotals	0.000	9.300

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable